

DOCUMENT RESUME

ED 081 633

SE 016 770

TITLE	Science Education Newsletter No. 22.
INSTITUTION	British Council, London (England). Science Dept.
PUB DATE	Aug 73
NOTE	40p.
EDRS PRICE	MF-\$0.65 HC-\$3.29
DESCRIPTORS	*Abstracts; Annotated Bibliographies; Conferences; Curriculum Development; Health Education; *Literature Reviews; *Mathematics Education; *Newsletters; Resource Materials; *Science Education
IDENTIFIERS	British Council

ABSTRACT

This newsletter contains a number of reports on recent activities in Britain in the areas of science and mathematics education. Other educational activities reported from Britain deal with the Schools Council projects in geography and health education. A detailed annotated bibliography of recent publications relating to science education is included, and a separate section presents abstracts of articles published in a variety of science education journals. Overseas activities are reported from Cameroon, Italy, Kenya, Latin America, and the United States, and Anglo-Dutch cooperation in science education is discussed. In the section entitled "International Activities," the outcomes of several international conferences dealing with science, integrated science, mathematics, and teacher education are outlined. The aims of the Guinness Awards for Science and Mathematics Teachers Overseas are provided together with entry conditions and suggested topics. (JR)

THE BRITISH COUNCIL

U.S. DEPARTMENT OF HEALTH
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Science Education Newsletter

Number 22 August 1973

Issued by

Science Department

FILMED FROM BEST AVAILABLE COPY

ED 081539

06 770

Issued by:-
Science Department
The British Council
27 Chancery Lane
London WC2A 1PL

CONTENTS

ACTIVITIES IN BRITAIN - SCIENCE

1. Processes of Science Curriculum Development - British Council Course
2. Schools Council Project - Progress in Learning Science
3. Chemical Nomenclature
4. Science and Technology Information Sources - SATIS
5. Chemical Society - Education Division
6. University of Keele - MSc (Education)
7. Scottish Projects in Science

ACTIVITIES IN BRITAIN - MATHEMATICS

8. Curriculum Development in Secondary Mathematics - British Council Course
9. Primary Education in Scotland - Mathematics Curriculum Paper 13
10. Science Uses Mathematics (SUM)
11. The Mathematical needs of 'A' level Physics students
12. Mathematics Survey
13. Small Computer Users Group
14. Scottish Projects in Mathematics

ACTIVITIES IN BRITAIN - GENERAL

15. Geography for the young school leaver - Schools Council Project
16. Schools Council Project-Health Education 5 - 13

17. PUBLICATIONS

18. SCIENCE EDUCATION ABSTRACTS

OVERSEAS ACTIVITIES

19. Anglo-Dutch Co-operation in Science Education
20. Cameroon
21. Italy
22. Kenya
23. Latin America
24. USA

INTERNATIONAL ACTIVITIES

25. European Science Education Seminar
26. Commonwealth Specialist Conference on Teacher Education
27. Guinness Awards Commonwealth Conference on the Social Significance of Science and Mathematics Teaching
28. International Conference on the Education of Teachers for Integrated Science
29. International Confederation of Association for Science Education (ICASE)
30. Guinness Awards for Science and Mathematics Teachers Overseas 1972/73 and 1973/74

ACTIVITIES IN BRITAIN - SCIENCE

1. Processes of Science Curriculum Development British Council Course August/September 1974 Dundee and Nottingham

This is the title of a new British Council course aimed at people involved at all levels in curriculum development work. The course aims to concentrate on the processes by which curriculum development is carried out, to analyse British experience in this field in relation to the problems posed in the United Kingdom and to extend this analysis to consider the general problem of curriculum development in science education. The course will be held in two parts at Dundee at the Scottish National Centre for Science, Mathematics and Technology Education under directorship of Mr John Hughes and at the Department of Education of the University of Nottingham under the direction of Professor J F Eggleston. The course will last for four weeks.

Further details will be available shortly from your British Council Representative or from Science Education Section, The British Council, 27 Chancery Lane, London WC2A 1PJ, England.

2. Schools Council Project - Progress in Learning Science (See SEN 21:4)

This project which started in April 1973 under the direction of Dr Wynne Harlen at the School of Education, University of Reading has now produced Information Paper Number 1. This gives further details about the project, why it exists, what it exists to do and the first steps that it will take. Copies of the Information Paper may be obtained from the Director of the project, School of Education, University of Reading, London Road, Reading RG1 5AQ. It should be noted however that it will not be possible to provide examples of the project's materials before 1975, but those who are interested may be kept informed as to the progress of the project through circulation of newsletters and papers such as this first Information Paper.

3. Chemical Nomenclature (See SEN 20:20.5)

The United Kingdom General Certificate of Education Boards have produced a joint statement concerning the use of chemical nomenclature in GCE chemistry examination papers, in which they draw attention to the Association for Science Education publication 'Chemical Nomenclature, symbols and terminology', which will be the main guide for setting chemistry papers in the future. The initial efforts of the working party of the Association have thus come to a successful conclusion. The report is available from the Publications Department of the Association for Science Education, College Lane, Hatfield, Hertfordshire, England price 75p which includes postage in the United Kingdom.

4. Science and Technology Information Sources - SATIS (See SEN 13:28.1)

This publication is now entering its fourth volume and is rapidly achieving growing recognition as a prime source of abstract information in mathematics, earth sciences, biological sciences, chemistry, physics and technology. In addition there are sections covering education and the social significance of science and technology as well as abstracts of projects.

A growing team of experienced teachers examines over 250 journals in science, technology and education regularly abstracting that which is relevant of the teacher and indicating the level for which a material is most suitable. Abstracts are cross referenced so as to be readily retrievable under more than one heading where appropriate.

Photocopies of most of the items listed are available from the National Lending Library provided that copyright conventions are observed. British Council offices overseas operate a National Lending Library photocopy service and for details you should apply to your local British Council office.

The scope and efficiency of an abstract service becomes more efficient as the circulation of such a journal increases, financial resources which are thus provided can then be deployed to support a wider range of abstracting operations. The subscription rate for SATIS is £1.75 and orders should be placed with the National Centre for Schools Technology (NCST) Trent Polytechnic, Burton Street, Nottingham, NG1 4BU England. We hope that many of our readers who do not already subscribe to SATIS will take out subscriptions to the Science and Technology Information Sources service and support its activities.

5. Chemical Society, Education Division (See SEN: 20:7)

This is the second year of the new Chemical Society and the Education Division now has well over 5000 members. It has three affiliated subject groups covering the fields of assessment, curriculum and educational techniques. The Council of the Education Division has elected Mr Martin Berry of Chislehurst and Sidcup Grammar School as its President for 1973/74 succeeding Professor M J Fraser of the University of East Anglia. The Secretary of the Division is Mr E W Jenkins, University of Leeds.

Recent activities have included the Annual Meeting at the University of Leeds from 5 - 7 July with three major topics: an exhibition of audio-visual aids in chemistry teaching; a symposium on chemistry for the less able pupil and a symposium on world-wide problems in chemical education.

Recent publications from the Division include the report of the symposium on "The role and nature of experimental work in chemistry courses" held at Nottingham University in September 1972. This is available from the Assistant Education Officer of The Chemical Society, Burlington House, London W1V 0BN, price 50p. This looks at the whole range of practical work and its relation to the development of chemical understanding at both secondary and tertiary level. The viewpoints of both the school teacher, university teacher and the potential consumers are taken into account in the various papers presented.

The report of the recent Education Division's Symposium "The Discipline of Chemistry - its place in Education" will be available shortly, and contains papers by many of the leading figures of chemical education in Britain: its price will be 75p and it will be obtainable from the Education Officer as above.

Forthcoming activities include: a joint meeting of the Education and Industrial Divisions on Chemical Education in Industry at the University of East Anglia during the autumn meeting in September 1973 and a curriculum development workshop being organised by the Scottish region to be held in November 1973 at the Jordanhill College of Education. In addition there are now eight regional groups active in the Chemical Education Division, covering most of the British Isles. Some 20% of the membership of the Division comes from overseas and in order to serve the interests of these members better it has been decided to appoint corresponding members in each country to receive information from the Division and circulate this within his own country. In addition Mr D G Chisman has been co-opted to the Council of the Education Division to represent the interests of the overseas members.

6. University of Keele - MSc (Education)

This is a new one-year full-time course to be offered by the Department of Education at the University of Keele in conjunction with the Department of Chemistry, Mathematics and Physics.

The course is aimed predominantly at experienced teachers and lecturers who are concerned with the teaching of mathematics and science for the 11 - 18+ range both in schools and further education. Suitable candidates who have recently graduated in education and mathematics or education and a science will also be considered. The course will enable members to assess critically the current changes in relevant curricula and will prepare them to participate more effectively in the process of curriculum change. There are three main components: mathematics education and/or science education; specialist courses in mathematics or chemistry or physics or physical science as appropriate and individual work of an original nature emphasising the relationship of current thinking in mathematics education or science education to the teaching of the specialist subject at the secondary or tertiary level or to other fields, eg industrial training.

Further information can be obtained from The Registrar, The University of Keele, Keele, Staffordshire, ST5 5BG, England. The course will be offered for the first time from October 1974 and adds yet a further dimension to the growing range of masters degree courses being offered for science and mathematics education in the United Kingdom. The University of Keele has a long established reputation in joint honours courses at first degree level and this new course in science and mathematics education at masters degree level continues their excellent tradition in this field.

7. Scottish Projects in Science (See SEN 21:1)

The Scottish developments in 'O' and 'H' science studies: Physics, Chemistry and Biology for 12 - 17 year old age range which have been in operation since 1962 should also be considered to have the status of curriculum projects and should be added to the select list given in SEN 21. The projects are coordinated by the Scottish Certificate of Education Examination Board in cooperation with the Scottish Education Department and in particular with the Scottish National Centre for Science, Mathematics and Technical Education at Dundee.

ACTIVITIES IN BRITAIN - MATHEMATICS

8. Curriculum Development in Secondary Mathematics - British Council Course
Nottingham 24 March - 6 April 1974

The case for curriculum reform in mathematics rests on the conviction that school mathematics courses should reflect the contemporary condition of the subject, both in terms of its appeal as one of the great achievements of the human spirit and in terms of its relevance to wide areas of human society (effects which are greatly intensified by the power and potentiality of the computer). Such concerns are reflected in attitudes to the teaching of mathematics throughout the world and in the widespread concern which accompanies changes in content or methods of presentation. A characteristic feature of the reform movement in the United Kingdom has been the free association of groups of school teachers, who have developed new syllabuses, written new texts and devised novel classroom material. Another feature is the general belief that in learning mathematics one proceeds from the concrete to the abstract; an approach which lends itself to the preparation of vocational skills, as well as the training of future specialists and which is suitable for children of all abilities.

The course will review the British projects in general terms and copies of all the texts and materials will be available for more detailed discussions. Opportunities will be provided for participants to gain an appreciation of the aims, objectives and methods of the projects and to discuss the work with practising teachers and those concerned with the training of teachers, both initially and in service. The most fundamental activity, however, will be the discussion of the principles which underlie curriculum reform in mathematics both in practical classroom terms and in relation to the contemporary practice of pure and applied mathematics.

Accordingly the main emphasis in lectures and discussions will be on curriculum development and the objectives of a mathematical education and on the various support activities which are necessary to translate it into good classroom practice. In addition there will be courses on mathematics (for example probability and statistics; transformation geometry; or other topics if there is sufficient demand). Time will be available for extra request sessions.

There will be a permanent exhibition of books, work cards, class work and games and a workshop.

Opportunities will be provided for visits to schools, teachers' centres and colleges.

The course will be directed by Professor J V Armitage and members of the Shell Centre for Mathematical Education. The Shell Centre is established within the University of Nottingham for research in the teaching of mathematics at all levels and for the provision of resources for in service training of teachers. It is associated with the School of Education and the Department of Mathematics in the University and has close links with colleges of education, teachers' centres and schools throughout a wide area. The lecturers and tutors will be representative of the work being done throughout the country.

Those attending this course must have a sufficiently good knowledge of English to enable them to comprehend lectures in this language and to enter freely into discussions. The course will be concerned with the secondary school curriculum up to university entrance. There will be opportunities for work at different levels, but all participants should have a good understanding of

traditional school mathematics at the 'O' and 'A' level and some familiarity with recent changes in the curriculum. For work at 'A' level a university degree or equivalent qualification is essential and it is desirable that all participants should be so qualified.

There are vacancies for 40 members. The course fee will be £95. Participants will be accommodated in a university hall of residence. Application forms must be received in London by 15 November 1973.

Further information and application forms can be obtained from your local British Council Representative, or from Science Education Section, The British Council, 27 Chancery Lane, London WC2A 1PJ, England.

9. Primary Education in Scotland Mathematics Curriculum Paper 13
Scottish Education Department 1973 HMSO Price 52½p

In 1965 the Scottish Education Department issued a memorandum entitled 'Primary Education Scotland'. It contained a section on mathematics which widened the field of mathematics considered appropriate for pupils in the primary school and recommended a new method of approach. Since 1965 several factors, such as the adoption of decimal currency and the gradual introduction of metric measures, have called not for a new approach, but for an updating and consolidation of the work originally outlined in the 1965 primary memorandum. It was to meet this need that Her Majesty's Inspectors of Schools in cooperation with a group of primary advisers from education authorities and lecturers from colleges of education prepared the current paper which has the approval of the Scottish Central Committee on Primary Education and of the Consultative Committee on the Curriculum. It is intended to serve as a handbook of guidance to the teacher in the primary school and of information to teachers of mathematics in the secondary school.

It considers the school situation in four separate stages: Primary 1-3, Primary 3-5, Primary 5-7, and links with the Secondary School. Within these sections consideration is given to questions of number, measurements, pictorial representation, shape, money, graphical representation, statistics and algebra, as appropriate. The publication provides a concise and most relevant commentary on many of the current development aspects of modern mathematics for the primary school.

10. Science Uses Mathematics (SUM)

For the last two years a Links Working Party consisting of representatives from the Association for Science Education, the Mathematical Association and the Association of Teachers of Mathematics have been looking into points of similarity between mathematics and science courses in schools and of ways of integrating courses so that the two subjects are mutually helpful.

Developments in mathematics (including new mathematics) and science courses at all levels in the secondary school have taken place independently and these have, if anything, tended to aggravate existing inter-departmental friction. This means that pupils who may be being given excellent teaching in two separate departments do not profit fully from the courses and artificial inter-disciplinary boundaries may be created.

There are possibly four areas for discussion:

a. Notation.

b. The subjects are taught at different times so that an advance in the science teaching is held up by the lack of mathematical technique.

c. Respectability. Most scientists think that mathematicians are too fussy and too rigorous.

d. Style. For example, mathematicians may object to a combination of words and symbols such as 'weight = 12g'.

Professor G Matthews (Shell Professor of Mathematics Education) at the Centre for Science Education, Chelsea College and his team are developing a series of short "modules of work" under a general project to be known as Science Uses Mathematics (SUM). The object of SUM is to provide interdisciplinary materials which will enable the departments to work together rather than merely express the desire to collaborate.

Thirteen schools have agreed to start trials from January 1973 on the two topics, a. symmetry and crystal structure and b. indices and molecules. Main topics under consideration include ratios, rates and measurement.

It is intended to publish an interim report in the Autumn of 1973. Unfortunately copies of the material are not at this stage generally available, but any teachers who have ideas for future modules or who may have been carrying out similar work already in their own school are invited to write either to Professor Matthews at Chelsea College, Fridges Place, London SW6, or to the Chairman of the Links Working Party, C A Crofts, Chorlton High School, Manchester M21 2XP.

11. The Mathematical Needs of 'A' Level Physics Students Physics Education
Vol 8 No 4 June 1973 Page 241

The contents of this article are drawn from a report of the joint Royal Society/Institute of Physics, Physics Education Committee. The report itself has been fully discussed with the joint Royal Society, Institute of Mathematics and its Applications, Mathematical Education Committee and amended in the light of comments by both mathematicians and physicists. The report arises out of discussions at a meeting in 1971 of the Joint Committee for Physics Education, which noted that a significant problem exists from the inability of students to use mathematical skills of the kind needed in the development and presentation of physics. The situation is certainly affected by the emergence of new style mathematics and physics syllabuses. At a more trivial level difficulties may also arise from the introduction of some new terminologies which differed from each other as well as from established usage. The article describes the study of a working party under Professor F S Edwards. The report comments that the working party found that in spite of the amount and diversity of information and views given to them they could unanimously agree on some precise and modest proposals which they felt would greatly improve the present situation. They found the need for and give in the report explicit suggestions on syllabuses namely:

- the basic mathematical needs for 'A' level physics candidates
- a further mathematics programme for those 'A' level physics students who proceed to undergraduate courses in physical sciences and engineering.

These items are given as detailed appendices to the report.

The conclusions and recommendations of the report are as follows:

11.1 A key feature of GCE 'A' level courses both in mathematics and physics is that they are followed by students who subsequently proceed to a wide range of studies.

11.2 Given the general purpose nature of such courses, they cannot be tailor made to suit the particular needs of aspiring specialists.

11.3 It is regrettable that the content of school courses in mathematics and individual sciences are at present almost wholly determined by specialists in the individual disciplines.

11.4 There is a need for a clear statement by all GCE Boards on the basic mathematical skills expected by their 'A' level Physics Examiners.

11.5 It would help in the formulation of such skills if the Panels of the GCE Boards were reconstituted so as to reflect in some measure the needs of those disciplines subsequently studied by successful candidates.

11.6 The substantial group of physics students proceeding to higher education studies in the physical sciences and engineering requires certain mathematical abilities additional to those needed for 'A' level physics. We would expect that most of these would be provided within 'A' level single mathematics.

Recommendations

11.7 Working Parties from the whole spectrum of physical sciences and engineering should consider both the basic mathematical needs of their 'A' level courses and the further mathematical needs of their future specialists.

11.8 The Joint Committee for Mathematical Education should discuss with the Working Parties how best these needs can be met alongside the new style of mathematics teaching.

11.9 All GCE Examining Boards should produce explicit statements of the mathematical abilities that will be required in their 'A' level physics examinations. Further, we recommend that these statements ought not to be confined to 'O' level mathematics.

11.10 The Subject Panels of the GCE Examining Boards should be reconstituted so as to include an adequate representation of the users of the subject.

Physics Education is published bi-monthly by the Institute of Physics, 47 Belgrave Square, London SW1X 8QX, England. The subscription rate for all countries except the USA, Canada and Mexico is £7.00 per annum; orders should be sent to Physics Trust Publications, Blackhorse Road, Letchworth, Herts SG6 1HN, England. Orders for North American countries should be sent to the American Institute of Physics, 335 East 45th Street, New York, NY 10017, USA.

12. Mathematics Survey

The possibility of surveying pupils' attainment in mathematics is being investigated by the National Foundation for Educational Research at the request of the Department of Education and Science. The investigation concerns pupils aged 11 years and 15 years in schools in England and Wales and costs about £31,000. Some preliminary work has already been done and the whole feasibility study will last until June 1974. It is being undertaken by Mr Robert Lyness, Mr John Dobby and Miss Clare Beeching of the NFER, under the direction of Dr Ray Sumner, Head of the NFER Guidance and Assessment Service. A steering committee exists to supervise the study and a working group of mathematics educators advises on the mathematics to be tested.

The feasibility study will not yield mathematics survey information: it will, however, indicate how possible it would be to conduct a survey of

mathematical attainment of the two age-groups. If it is possible, then surveys of mathematical attainment could, in future, indicate standards in certain aspects of mathematics. More information about numeracy would thus become available, complementing the information which exists on literacy.

During the feasibility study, a small sample of schools will be asked for help in pre-testing selections of mathematics questions. There will be no reporting on, or comparisons made between, individual children, classes or schools. The intention is to report on the distribution of the scores of large groups of randomly selected children.

If a mathematics survey does prove feasible, following this study, it could provide baseline data for future studies into changes in school mathematics and could also be used for special studies of particular groups or particular areas of mathematics.

13. Small Computer Users Group (See SEN 17:17)

A number of English schools have bought small computers recently and a group has been formed from teachers in these schools. This group was first described in Computer Education No 11. The Group has now doubled in size and has some manufacturing companies as associate members which provides a useful two-way effect in sharing ideas and information.

The current edition of Computer Education, No 14 June 1973 contains a special section dealing with the small computer users group and contains a series of articles covering the use of such computers. The introduction to the supplement states that the purpose of the series of articles is to spread ideas and persuade teachers that it is a relatively easy matter to install and use a computer in school. The articles do not advocate computers in every school and suggest that there is a strong case for one school in the area to house a multi-access machine to which terminals in neighbouring schools are linked. Small computers can be used in many ways.

The articles contained in the supplement are as follows:

Introduction	D Pegg
Aims and Methods for Computer Education	W R Broderick
Different Approaches with the use of Small Computers	
a. An introduction to Computer Studies with the aid of terminal	D Pegg
b. An Optical Mark Reader System	J Crampin
c. Computer Science 'A' level	G Batty and E Makin
The use of the Small Computer in the Teaching of Mathematics	
a. Below Sixth Form Level	R J Winfield
b. Sixth Form Mathematics and Statistics	H Williams
The use of a Mini Computer in a College of Education	R Atherton
A survey of Currently available Small Computers	M H Rhys

Of particular interest will be the descriptions of alternative approaches to the use of a small computer. The versatility of the use of the small computer in teaching mathematics is well illustrated in the article by Winfield and Williams. For those considering embarking on this field of activity the survey of the currently available small computers will provide valuable resource information.

Computer Education is a publication of the Computer Education Group, North Staffordshire Polytechnic, Computer Centre, Blackheath Lane, Stafford, England. The subscription is £1.00 per annum.

14. Scottish Projects in Mathematics (See SEN 21:11)

Mathematics with Statistics	12-16	1971-	Scottish Centre for Maths, Science and Technical Education	SEN 19:17
Mathematics for General Education	14-16	1973-		
Scottish Computer Educ Group	12-18	1970- B T Bellis	Moray House College of Education, Computer Centre, Edinburgh	Oliver & Boyd Heinemann Educational Books Ltd. SEN 15:9a.
Scottish Computers in Schools Projects	12-18	1970- N Smart	Aberdeen College of Education, Computer Department	Chambers SEN 19:12

ACTIVITIES IN BRITAIN - GENERAL

15. Geography for the Young School Leaver - Schools Council Curriculum Development Project (See also SEN 18:2)

As a result of the efforts of a small project team working at Avery Hill College of Education London over the past 2½ years, under the co-direction of Rex Beddis and Tom Dalton, trial materials have now been produced and are currently being assessed with a view to eventual dissemination and commercial publication, possibly later this year. Whilst the project has concentrated on developing techniques and a methodology designed to assist the less able in the age range 14-16, the aims and content of the project materials are designed to meet the need of 14-16 year olds of all abilities. The aim has been at all times to identify clearly the immediate relevance and interest of a world of rapid technological, economic and social change for the older secondary school pupil, particularly in those aspects which affect his vocational interests and his relationships with the community.

The theme adopted for the Trials is called 'Man, Land and Leisure', and aims at demonstrating examples of contemporary problems such as the inadequate provision of open space in inner-city areas and the increasing pressures on the countryside as a result of increasing affluence and mobility. The theme aims to express the contribution a geographer can make towards the understanding of these problems. The theme consists of 5 units:-

- Unit 1 The growing range and increasing significance of leisure
- Unit 2 Leisure provisions for local communities
- Unit 3 Leisure in the countryside - the National Parks
- Unit 4 Leisure and tourism in Britain and Western Europe
- Unit 5 Leisure - the future.

The theme develops in a concentric manner, progressing from the individual and the locality to national and overseas context. The Units have been developed with four criteria in mind:

- 15.1 The work should be concerned with all aspects of pupil development - understanding ideas, acquiring facts, developing skills, engaging attitudes etc.
- 15.2 Themes should be of interest and relevance to pupils now.
- 15.3 Ideas should be initiated by consideration of local environment and community, later to be extended to more distant parts.
- 15.4 Methods used should encourage full pupil involvement.

The entire theme is contained in a Teachers Set of materials which consists of a Teachers Guide and, separate from this, loose leaf resources comprising photographs, extracts from texts, maps, photographs, worksheets, etc. In addition film strips, colour slides, tape recordings and overhead transparencies are included. The provision of such a wide range of resources leaves the teacher free to make a personal selection according to the needs of pupils. By adaptation, the resources could be used in a mixed ability setting or in a streamed situation with more able pupils. The Teachers Guide sets out, for each part of the theme the key ideas which have been illustrated in the resources. Each part of each unit uses the following sub-headings:

Objectives:	Tabulated
Resources provided:	Listed
Advance Preparation:	Class materials which teacher needs to provide
Procedure:	Suggested methodology. Alternative suggestions made. Complete programming avoided, leaving teacher free to adapt procedure.
For further investigation:	Suggestions for extended activities, allowing for varying speeds of working and abilities.

The Teachers Guide also contains appendices as follows:

- Appendix 1 Suggestions for an interdisciplinary approach
- Appendix 2 London's Green Belt - supplementary information
- Appendix 3 Filmstrip - list of contents
- Appendix 4 Filmstrip notes
- Appendix 5 References.

The Project team has tested the resources in a wide variety of local environments with a full range of audio-visual and other facilities. The Project is geared to no existing prescribed syllabus, and in schools where examination classes are involved a Mode 2 or Mode 3 CSE syllabus (See SEN 16:5b.) may be needed.

16. Schools Council Project Health Education 5-13

The Schools Council will be sponsoring this new project from September 1973. The Project Director will be Trefor Williams at St Osyth's College of Education, Clacton-on-Sea, Essex. The aim of the project is:

- 16.1 To identify the concepts fundamental to health education.
- 16.2 To develop a rationale of health education professionally acceptable to teachers, and to further develop an encouraging environment in educational practice generally.
- 16.3 To develop teachers' guides for the health education of pupils aged 5-13 and to identify and develop materials to support them.

Initially the project team will develop a conceptual framework or structure to form the basis of the teachers' guides. These will take into account the core content of health education as identified by teachers, health education workers, medical personnel, parents etc in Great Britain and similar research undertaken in America, Sweden and elsewhere. The project will run for three years 1973-1976. During the development phase, it is hoped to work with 12 schools in each of three areas, with two teachers from each school working in writing groups to develop the materials.

It is hoped to develop videotape recordings from the materials specifically for diffusion purposes and to hold a number of conferences in the final year.

17. PUBLICATIONS

17.1 New Trends in Integrated Science Teaching, Volume 2 UNESCO Paris 1973 price £2.20

This is the latest in the UNESCO New Trends series and has been edited by P E Richmond, Senior Lecturer in Education, University of Southampton, United Kingdom. The publication forms part of UNESCO's programme in integrated science teaching which was launched in 1969. The principal reasons for starting the programme were:

17.1.1 It has become increasingly apparent that science must be an element in the general education of all children. However the majority of children in many parts of the world do not get beyond primary school. Clearly science needs to be introduced as an element in primary education and such science must of necessity be of an integrated type - or perhaps undifferentiated would be a better term.

17.1.2 At secondary level, if science is to be an element of general education, at least in the lower cycle of secondary education, some form of integrated science teaching is likely to be more appropriate than courses in the separate disciplines of physics, chemistry and biology.

17.1.3 Integrated science teaching at primary and secondary levels provides a sound basis for continuing science education either in specialist subjects or further integrated science.

The current volume contains a series of nine articles on various aspects of integrated science teaching drawn from authors in a variety of countries including the United Kingdom, the United States, Australia and from within UNESCO itself. The second part of the volume looks at a series of examples of projects drawn from Africa, the Caribbean, the United Kingdom and Israel. This volume is a valuable addition to the rapidly growing literature on the teaching of integrated science.

17.2 The Principles of Objective Testing in Chemistry C V T Campbell and W J Milne; The Principles of Objective Testing in Mathematics W G Fraser and J N Gillam; both published by Heinemann Educational Books Ltd., price £1.50 and £1.80 respectively.

In recent years there have been many publications of collections of objective tests some of which have indicated something of the mode of construction of such assessment tools. Rarely however have books directed at teachers given a thorough treatment of objective testing related to such questions as the purpose of examinations and their correlation with educational objectives either in general terms or in the context of individual subjects. These publications attempt to do this and to show how item construction for objective tests might be carried out. The publications proceed by considering the compilation of a complete objective test series followed by item analysis and test analysis. A general note on assessment and the advantages as well as the limitations of objective testing complete the work. A further volume in the series is entitled 'The Principles of Objective Testing in Physics' and is written by J G Houston.

17.3 Physics by Experiment S W Hockey and J R Mills Published by
Wheaton (Pergamon) price £0.55. Teacher's edition £1.15

The authors describe the aims of this book as being fourfold. To encourage and train the sixth form students for whom the book is written to work on their own; to present a set of exercises which reflect more closely than has sometimes been the case in the past, the kind of activity which the real life scientist engages in; to present a basic course of 50 exercises which will give a proper understanding of all the major concepts of a modern 'A' level physics course; to present a variety of practical work which will introduce all the more important techniques of modern experimentation.

The book is in two parts, the main text and a detailed teacher's guide published separately. Analysis of the list of experiments indicates how well the authors have achieved their aims of incorporating a wide range of exercises both traditional and modern. The illustrations and diagrams are neat and concise and clearly laid out and pupils should find no difficulty in following the experimental directions given. Experiments are divided into a basic course of 50 together with a series of 30 supplementary exercises perhaps of less central importance to the backbone of an 'A' level course, but calling for a deeper experimental understanding of physics. These will provide ample stimulation for the more advanced students. The useful note on experimental errors and their treatment is appended to the main text. In the teacher's guide version two additional sections are present, dealing with notes on the apparatus necessary to carry out the various experiments and a commentary for teachers on each of the individual experiments indicating why certain experimental procedures are followed and in some cases suggesting additional treatment of experiment or of the results. Most of the individual exercises are followed by a series of questions to the pupil and the teacher's commentary contains the answers to these questions.

17.4 Studies in Chemistry Series

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|----|--|-------------------------|
| 1. | Chemical Equilibria P J Hills | price £0.95 (pbk £0.53) |
| 2. | The Modern Gas Industry D Scott Wilson | price £1.05 (pbk £0.65) |
| 3. | Chemical Kinetics N R Waite | price £1.05 (pbk £0.65) |
| 4. | The Fine Organic Chemicals Industry
T F McCombie | price £1.25 (pbk £0.75) |
| 5. | Petrochemicals Today J P Stern and
E S Stern | price £1.30 (pbk £0.75) |
| 6. | The Chemistry of Fibres J E McIntyre | price £1.30 (pbk £0.75) |
| 7. | The Rusting of Iron, Causes and Control
U R Evans | price £1.50 (pbk £0.75) |

In preparation:

Noble Gases and their Influence on Theories
of Chemical Bonding G P Rendle
Photochemistry P Borrell, published by
Arnold.

This series which is edited by B J Stokes and A J Malpas aims to stimulate students' interest in the application of chemical principles learned in a school sixth form or technical college to practical problems of modern life. While it is necessary that special attention should be given to the basic principles of subjects, the influence of chemistry upon industry, medicine, agriculture and indeed the whole structure of society is both immense and increasing. The editors emphasise that no chemical education should be thought complete without some informed

acquaintance with the impact of chemistry on society and if the benefits of scientific progress are to continue capable students must be stimulated to take up careers in applied fields.

Standard chemistry textbooks seldom are able to delve into the engineering, technological and economic aspects of applied chemistry and this series of publications fills an important niche in the literature currently available. In many cases the book starts with a theoretical discussion and sometimes a historical introduction which will be familiar to users of more standard textbooks. It rapidly moves into areas which would be considered quite inappropriate in a normal 'A' level text. Such books must be considered essential reading for any student contemplating a career in chemistry or chemical engineering and many teachers whose own knowledge of applied chemistry is in need of renewal will find them interesting and stimulating.

17.5 Chemistry by Concept A Spiers and D Stebbens Heinemann Educational Books price £1.60

This book is subtitled 'A comprehensive account of the principles of chemistry for GCE 'O' level and CSE courses'. The authors state that this book is intended to be a departure from the usual textbook of chemistry. Where modern syllabuses are coming more and more to stress pattern rather than facts, it is important that some books should appear designed to reflect that trend. This intention of the authors has indeed been very effectively put into practice in this publication.

Teachers used to the pattern of conventional chemistry textbooks will be surprised on meeting this book for the first time. The emphasis is on summarising ideas after fairly brief reviews of evidence. No experimental instructions are included other than the experimental summary diagrams. The intention is to clearly chart the principles of chemistry and to provide clearly summarised data outlining the patterns observable within chemistry itself.

The early chapters introduce a certain amount of data as 'hats to hang on the pegs' and some later chapters summarise factual information. The majority of the book however is concerned with presenting the basic patterns observable within chemistry. Atoms and molecules, periodic classification, energy changes in chemistry, rates of reactions, electrical aspects of chemistry and some aspects of carbon chemistry form the major portion of material. The diagrammatic material is particularly well presented and should be easily understood by the student. A collection of interesting and stimulating questions relating to the subject matter of each of the chapters forms the final section of the book.

This book forms a valuable addition to the literature available for the study of chemistry up to 'O' level, and will be a valuable source book for CSE work.

17.6 Investigating Chemistry L Davies, N J Denial, A W Locke and M E Reay Heinemann Educational Books Ltd price £1.80 Teachers' Guide £2.00

This book sets out to produce a chemistry course which combines the best of more traditional with the modern approaches to the teaching of chemistry. It is intended to be suitable for schools following any of the 'O' level courses prescribed by the major examining boards.

Considerable emphasis is placed throughout on structure in its relation to properties. Ideas about atomic structure, bonding and periodicity are

introduced early in the course. All the topics recently introduced into 'O' level schemes such as energy changes, simple kinetics, detergency, organic chemistry and polymers are included in the material, but instead of treating them in isolation such topics have been incorporated into the text wherever they form part of a continuous sequence of chemical interest.

One of the problems facing teachers with modern chemistry courses is whether or not to use a textbook and what sort of a textbook to use. Many pupils find that a textbook is a valuable supporting item which reinforces the experimental work performed in the laboratory. To fulfil this function however a textbook needs to be very carefully related to experimental investigation of matter which is the basis of all chemical studies. The authors of this particular book are to be congratulated on the way in which they have combined an approach to experimentation with the theoretical issues arising out of it, and discussions of such points with the provision of additional information which is not amenable to treatment by experiment either by reason of its quantity, complexity or the sophistication of the experimental material needed to verify such details. Experimental instructions are given for a wide range of appropriate investigation and a range of questions is appended to each chapter drawn partly from the examination papers of a range of examination boards.

The material is well presented, diagrams partly of a cartoon type are easy to follow and the book as a whole has an attractive layout. The book is something of a landmark in the present discussions on development in chemical education and deserves close study.

17.7 The Teaching of Mathematics in the Primary School. Mathematics Department, Cardiff College of Education Published by J D Lewis and Sons Ltd price £0.80

This is an account of a suggested scheme of work prepared by the staff of the Mathematics Department of the Cardiff College of Education. The work outlined in the book has formed part of the general course in mathematics for all students in the college for some years. It covers work on number and graphical representation only. It is hoped that further books will be produced dealing with other aspects of work on mathematics to primary schools in due course. The author says the work is based on three teaching principles. That children should develop at their own rate, that children should be free to experiment and discover rules and relationships for themselves and that the essential structure of the subject is made plain. The book is essentially a teachers handbook, and will interest most teachers of the subject.

17.8 New Trends in Mathematics Teaching Volume 3 UNESCO Paris price £1.15

Each of the volume's ten chapters is intended to present an objective analysis of the trends in some important sub-topic in the overall domain of mathematics education, together with bibliographies facilitating fuller study. In an epilogue, the various contributors jointly express, in a more subjective way, their ideas and hopes for mathematics education.

New Trends in Mathematics Teaching is part of a larger series on The Teaching of the Basic Sciences, published by UNESCO, which includes works on new trends in teaching biology, chemistry and

physics, and in integrated science teaching. Other titles are A Survey of the Teaching of Physics at Universities and Mathematics Applied to Physics.

17.9 Simple Slide Rule British Thornton Ltd PO Box 3 Wythenshawe
Manchester M22 4SS price £1.80

This is a pack of 25 learning cards plus teachers' notes and answers. The object of this learning card programme is to encourage an understanding of the basic principles of the slide rule and how to use it for various calculations including multiplication, division, ratio and proportion. The slide rule is now recognised as an invaluable aid to calculation. School children and students of different ages and at different stages of progress should have the opportunity to discover its usefulness and versatility. The aim has been to minimise as far as possible the involvement of the teacher, this of course will vary according to the age and ability of the student. The programme is suitable for use in late primary, middle and secondary schools and has been tested and used successfully by pupils from 10-15 years old. It is also suggested that these cards could be used by fifth year leavers who are not on an examination course to help them obtain a better understanding of many mathematical concepts.

17.10 Discovering Biology J J Head published by Oxford University Press

Consisting of:

- i. A book of problems in vertebrate Zoology with special reference to man. 144 pages. £1.50
- ii. Teacher's Guide. 64 pages. £1.00.

This book is intended for senior secondary school Biology classes. The emphasis throughout the series of 156 problems, is on the ability to handle and understand data, to plan controlled experiments and to speculate about the interpretation of results. The book is unique insofar as the problems often introduce new material, not normally found in standard texts at this level. The book is very extensively illustrated by photographs (which are used as specimens for observation and inference) graphs, tables of data and clear line drawings. The Teacher's Guide contains factual answers to the structured questions where appropriate, and discusses the kinds of answers a student might produce to the speculative type questions.

17.11 16-19 Growth and Response: 2, Examination Structure Schools Working Paper No 46 Evans/Methuen Educational price 30p
Preparation for Degree Courses Schools Council Working Paper No 47
Evans/Methuen Educational price 95p

These two Schools Council Working Papers contain proposals for two new examinations for sixth forms, one of which would replace the 'A' level examinations. The aim is to reduce early specialisation and provide more variety, leading to a broader curriculum at the sixth form level. The two examinations proposed follow the rejected proposals for 'Q' and 'F' examinations first put forward in 1970. The new proposals are for:

17.11.1 A Certificate of Extended Education (CEE), to be based on a one-year course in the sixth form, is aimed at the 90% of all non-traditional sixth formers (about 40,000) who leave school at 17 without any 'O' level or CSE qualifications.

17.11.2 A new two-year course leading to an examination at 18 plus, which would replace 'A' levels and which would be taken at two levels in five subjects. All five could be taken at 'Normal' (N) level,

while one or two subjects selected from the group could be attempted at 'Further' (F) level. The five subjects at Normal level are said to be of a standard above the present 'O' level examination but below the 'A' level standard. The 'F' examination will be equivalent to 'A' levels. Universities would be asked to require no more than two 'F' level subjects as entry qualifications. This demand is expected to be controversial as most universities require applicants to have three 'A' level passes at present. The proposals spelled out in detail in the two separate reports are presented as 'Discussion documents'. The views of universities, teachers and employers will be sought. Before implementation the proposals will require approval from the Schools Council's governing body and from the Education Secretary. Feasibility studies would also have to be undertaken. If accepted, the proposals concerning CEE could be introduced by 1975-76 but the more controversial 'N' and 'F' examination proposals are unlikely to be implemented before 1978-79.

17.12 Assessment Techniques - An Introduction Edited by B Hudson
published by Methuen Educational price £1.35 (educational
paperback)

The trend towards increasing teacher participation in public examinations is obviously growing, and there is a clear need for today's teachers and lecturers to have a basic knowledge and understanding of examining methods, to enable them to play an effective role in public examinations, career guidance and diagnostic purposes. This book is intended to assist all concerned with examinations - teachers, examiners and administrators - to improve examining methods. The authors do not just give practical guidance; they also explain the principles of assessment, using relevant examples without jargon wherever possible. The book is the work of a team experienced in public examinations and includes topics on: the fundamental principles to be taken into account when planning a test; ways and means of dealing with marks; structured questions; essay-type questions; objective tests; internal assessment procedures for moderating school-based assessments to relate them to regional or national standards.

17.13 Science Policy

This is a journal published bi-monthly by Science Policy Foundation London in collaboration with the Organisation for Economic Cooperation and Development (OECD) Paris. Volume 2 No 1 January/February 1973 includes articles on a ten-year plan for education in Britain which places its emphasis on improved nursery facilities and buildings and more teachers and teacher in-service training. A further article describes the Australian National Science Centre which is the result of an experiment in bringing science and its responsibilities to all sections of the community. Science Policy can be obtained from Science Policy Limited NT, Linkside West, Beacon Hill, Hindhead, Surrey, England. Subscription is £9.50 or £11.50 by air mail per annum.

17.14 Educational Development International - CEDO Journal

This is the new journal of CEDO (The Centre for Educational Development Overseas), which was officially launched on 9 May 1973. The journal will include keynote articles by leading educationalists of international reputation and case studies giving practical details

of approaching projects, discussing problems and solutions. There will be practical articles dealing with all aspects of the use and production of audio-visual aids from the flannelgraph to the language laboratory. Projects are not to be confined to the classroom but will cover formal and informal education at all levels. The first journal includes articles as follows:

Curriculum Change - Revolution or Reform? by Robert Morris
Director of the Curriculum Division of CEDO

A School Science Project for India by S V C Aiya
Director of the National Council for Education Research
Training New Delhi

The African Social Studies Programme by D V Owiredo
Executive Secretary

Goals of Education: Aspects of the Experience of the 60s by
Asa Briggs Vice Chancellor of the University of Sussex

Subsequent issues will adopt a thematic approach: in the next issue this will deal with primary education. It is planned to include articles on primary education in Guyana, Malaysia and Zambia, on primary education in rural development and the various aspects of primary mathematics and science.

The journal is published for the Centre four times a year by Peter Peregrinus Limited, 1973/74 (18 months subscription rates libraries: £11 individuals: £7.25 bulk rates are £4.00). All subscription enquiries should be addressed to R C Sutton, Marketing Manager, Peter Peregrinus Limited, PO Box 8, South Gate House, Stevenage, Hertfordshire ST1 1HQ, England.

18. SCIENCE EDUCATION ABSTRACTS

- 18.1 Pre-School Pre-Mathematics: Geoffrey and Julia Matthews
Mathematical Gazette Volume 57 No 400 June 1973 Page 97

This article looks at the area of children's experience in mathematics in the pre-school age range, say 3½ to 5 years of age. The article goes on to describe a series of areas of activity which could be described as nursery mathematics. This includes activities such as matching, sorting, comparison of numbers and elements in two sets, ordering, sharing, shapes, length, sizes, perspective and symmetry. The article is full of a refreshing practicality in the approach to this work.

The Mathematical Gazette is the journal of the Mathematical Association and is published four times a year. The journal is published by G Bell and Sons Ltd and its subscription is £1.00 per issue to non-members.

- 18.2 Development and Future Trends in Precision Weighing Dr F B Hugh-Jones
Scientific Instrument Centre Ltd
Balances for School Use J R Carleton Habdashers Aske's School
Science Teaching Equipment Volume 9 No 13 May/June 1973 page 4

One of the main contributions that developments in scientific apparatus has made to modern experimental work has been through the availability of accurate quick weighing machines of one kind or another.

These two articles attempt to survey some aspects of the development of precision weighing and in particular to look at the applications for school use. Science Teaching Equipment is published by Milton Publishing Co Ltd., 28 Craven Street, London WC2N 5PD.

- 18.3 Iron and Education in Uganda J Haden
Education in Chemistry Volume 10 No 2 March 1973 page 49

In a developing country like Uganda developments in education should not just lead to better informed and more interested pupils but should also be a powerful agent for social change. At present the change is largely destructive in terms of the village society. This article describes a chemistry project of a kind that might help to do something to reverse this trend. Considerable efforts have been made in the last five years to make chemistry teaching in East African Secondary Schools more relevant to the needs and backgrounds of students. A central feature in this has been the East African School Science Project based on original material and on the British Nuffield Chemistry Project. This has incorporated much material of local relevance. The author suggests however that even where SSP Science has gained a foothold two problems remain, the lack of confidence in the student and the cultural conflict between home and school, where school is seen primarily as the escape route from the restrictions, frustrations and boredom of the village home. It is acknowledged that there are no easy solutions to either of these problems, but goes on to describe a most interesting development based on iron smelting and its connections with reduction in chemistry. The work began with a conventional discussion of iron as a reducing agent following the lines of the Nuffield Chemistry Project. Studies of charcoal burning, which proved to be important locally, led on to the local blacksmith and to the question of traditional methods of iron smelting. This has never been described before in North West Uganda. A thorough investigation of the

traditional iron smelting procedures was made and the author comments that Uganda, while having no coal, has plenty of iron ore, forests and a history of successful smelting. The feasibility of charcoal smelting on a large scale is now to be investigated at Jinja. This fascinating account of a chemistry project follows a pattern which could well be imitated elsewhere and in other contexts.

Education in Chemistry is published by the Royal Institute of Chemistry and the Chemical Society in January and alternate months each year. The subscription rate is £5.00 per annum, single copies £1.25 and enquiries regarding subscriptions should be addressed to Chemical Society Publications, Sales Office, Blackhorse Road, Letchworth, Herts SG6 1HN, England.

18.4 Biology and the Peasant Farmer G M Coverdale
Journal of Biological Education Volume 7 No 2 April 1973 page 40.

This article is concerned with the link between education and rural development in the underdeveloped countries which account for more than half the world's population and most of its poverty and malnutrition. As a rule in these countries, in the region of 90% of all people live and work in the rural areas and it is precisely here that the process of modernisation has thus far made its smallest impact. It is in the rural sector where the development process must be accelerated. Bringing new knowledge to peasant farmers is probably the most productive investment which can be made in any of the poorer agricultural economies. Yet all too frequently the villager seems to prefer the familiar and the traditional. The author suggests that, while there is no slick and easy solution to the problem of rural development, if a peasant farmer possessed even the most basic rudiments of biological know-how he would be much more adaptable and amenable to technological innovation. In general the world over, the farmer with the greatest understanding of plant and animal behaviour is the one who is most sympathetic to change. The author goes on to discuss the aims of education and functions of the rural school as one of the mechanisms of education. The position of the teacher in the school and the community is also emphasised. The need for developing mechanisms of vocational training and the use of extension workers is discussed as is the function of the university in producing the higher level agricultural know-how. The author emphasises that the introduction of biological education should be carefully programmed and should be administered by rural teachers, trainers and extension workers who are able to apply themselves wholeheartedly to helping in the awakening of the countryside. The author is in the School of Education, Macquarie University, Sydney, Australia.

18.5 Material available for Environmental Education J Elliott
Journal of Biological Education Volume 7 No 2 April 1973 Page 33

The author has been concerned with the development of environmental studies as a complementary study for non-science advanced level students. The work was initially based on a syllabus compiled by the Conservation Society. This article summarises the films and other materials which have been used throughout the course to illustrate various aspects in environmental education. Films, slides, charts, posters, leaflets etc are included as well as suggestions for outside visits and the use of external lecturers. This is a useful resource article for teachers contemplating similar activities.

The Journal of Biological Education is published six times a year for the Institute of Biology by Academic Press Incorporated (London) Ltd, subscription rates for overseas \$10 plus \$1.10 postage. Subscription orders

may be placed with Academic Press Incorporated (London) Ltd, 24-28 Oval Road, London NW1 7DX, with the exception of those originating in the USA, Canada, Central America and South America which may be sent to Academic Press Incorporated, 111 Fifth Avenue, New York, NY 10003, USA.

- 18.6 Venn Diagrams Must Go? (1) Mathematics Teaching No 60 September 1972 page 34
Venn Diagrams Must Go? (2) Mathematics Teaching No 61 December 1972 A Sherlock and T Brand
Must Venn Diagrams Go? J A Dodridge Mathematics Teaching No 62 March 1973.

The authors of the first two articles claim that apart from the projects which are at the moment consolidating development in mathematics education and a few enthusiastic amateurs, very little seems to be happening in terms of genuine research. It is not enough to introduce new topics; they must be looked at carefully and if they are to be taught, they should be taught in their "best way" at the "correct" age to the "right" children. As the central theme of the articles they take the present pattern of teaching of Venn diagrams and suggest that while they may be suitable for initial introduction of such ideas their unsystematic outline is inadequate for future work. They suggest the alternative use of Karnaugh maps, or Veitch diagrams. They suggest that the ideas of Karnaugh maps should supplement existing material on sets and Boolean algebra and should provide an opportunity for less able pupils to solve problems even when their ability to manipulate Boolean functions is very limited. In the second article the authors provide an interesting analysis of Karnaugh maps, switches and switching circuits. The algebra of switching circuits is Boolean algebra and each circuit can be represented by the use of such maps. A somewhat contrary view is expressed in article No 3 by Mr Dodridge who contends that while Karnaugh maps provide additional imagery they are not alternatives to Venn diagrams and suggests that Venn diagrams lead more easily to understanding rather than to blind manipulation. He also considers Karnaugh maps to be more complicated for use in chemistry, physics and mathematics than simple Venn diagrams which are probably adequate up to and including three sets of items. Mr Dodridge pleads for the retention of Venn diagrams. These articles highlight an interesting debate on the further development of such concepts in mathematics teaching.

Mathematics Teaching is published quarterly by the Association of Teachers of Mathematics, Market Street Chambers, Nelson, Lancashire BB9 7LN, England and supplied free to members of the Association. Membership fee £3.00 per year.

- 18.7 Social and Subject Factors in Attitudes to Science M B Ormerod
School Science Review Volume 54 June 1973 No 189 page 645

Interest in the 70s in science education, as in other subjects, is shifting to the affective domain.

What makes a pupil like or dislike a subject?

How can we induce attitudes in pupils which enable us to lead them instead of driving them?

The emphasis now being placed on the affective domain as well as the cognitive and psychomotor domains is part of a growing social awareness at all levels within the community. There is little direct evidence of the methods by which we can affect pupils' attitudes towards science and its social implications. Much teaching method is based on a hunch. This article describes the research of the author into the social implications of science and children's attitudes. It contains a description of the construction of an attitude scale together with the actual scale selected for this particular study. This study was carried out on pupils in the third year of secondary education. The year in which the decision is usually made as to whether the pupil will effectively go on to arts or science in tertiary education. The article goes on to discuss the results of the application of a particular attitude scale to a group of children from fourteen schools in various parts of the country.

The author concludes that there is clear evidence that by the third, and with the most able, by the second year of education attitudes to the social implications of science had emerged. There is sound statistical evidence that attitudes to the social implication of science, as measured by the test described, were related to the science subject choices of the most able girls. There has been no satisfactory explanation of the low proportion of girls opting for the sciences in Western democracy and this perhaps provides a clue.

School Science Review is the journal of the Association for Science Education and is published by John Murray in September, December, March and June. Annual subscription £5.50 including postage inland or abroad.

OVERSEAS ACTIVITIES

19. Anglo-Dutch Cooperation in Science Education

An exchange of visits between the Association for Science Education in Britain and the Netherlands Science Teachers' Association has been a regular feature at their Annual Conferences in recent years. Opportunities for more detailed cooperation have on the whole been lacking until recently.

With the growth of interest in British developments in science education and a desire to conduct a revision of their own science curricula, the Netherlands science educationists sought ways of extending their contacts with Britain through the Association for Science Education and the British Council.

Knowing of the Council's interest in professional collaboration of this kind, discussions took place on how Britain might best assist the Dutch teachers. At the same time a visit by the Director of the British Council's Science Department to the Netherlands enabled the Council to make direct contact with the Dutch teachers' groups.

As a result of these contacts three developments occurred.

In April 1973 three British science educators, well versed in modern curriculum developments in the United Kingdom spent a week in the Netherlands discussing these new curricula and methods of curriculum development with the Dutch curriculum groups. They were Dr A H Johnstone, University of Glasgow Chemistry Department, Mr J Harris and Mr R Nicodemus of the Centre for Science Education, Chelsea College.

In May 1973 seven leading Dutch science educators came to Britain on a study tour to look at British developments in greater detail.

A marked feature of science curriculum development in Britain has been the major involvement of practising teachers at all stages in the creation of new teaching materials. In the Netherlands the interest of the teachers is becoming equally marked. In response to a request to provide an opportunity for members of the Netherlands Science Teachers Association to learn something of British developments at first hand, the British Council will, in August 1973, run a one-week course for 120 Dutch science teachers at Goldsmith's College with the assistance of Goldsmith's College staff and the Association for Science Education.

20. CAMEROON

In February Mr D A Quadling of the Cambridge Institute of Education visited the Cameroons under the auspices of the British Council to hold discussions and to conduct courses for teachers and educational officials with particular reference to the introduction of modern mathematics into the schools and colleges in two Provinces of the United Republic of Cameroon.

Courses were held in Buea and Bamenda and the participants proved most enthusiastic and receptive to ideas on the teaching of modern mathematics. Partly as a result of the meetings in connection with this tour two mathematics teachers groups have been set up in the Provinces concerned.

21. ITALY

During late March and early April Mr L F Ennever, Director of the Schools Council Science 5/13 Project and Mr H Faulkner of the Centre for Science Education, Chelsea College visited Italy under British Council

auspices to hold discussions with key teachers, teacher educator groups in Italy on the subject of Science Curriculum Development and in particular on the objectives and practices of science teaching in the United Kingdom and some of their possible implications in Italy.

Meetings were held with a group formed from lecturers and researchers in the University of Rome and from teachers in Italian schools in and near Rome; a group of teachers from Italian schools in Florence and a group of members of the Seminario Didattico in the University of Naples.

Partly as a result of these meetings some follow-up discussions and courses are being arranged and it is hoped that a further specialist from the Schools Council Science 5/13 Project will be able to join in a residential course for Italian teachers in Florence in September 1973. Further exchanges between England and Italy in this context are also being planned. There has been some considerable interest in British science education development in Italy in recent years. One of the most recent examples of this being the translation of the Nuffield Combined Science Materials into Italian by Messrs Zanichelli of Bologna.

22. KENYA

The first issue of POST Magazine published by the Kenya Committee for the Popularisation of Science and Technology has been produced in Nairobi.

Its purpose, as stated by Mr Taita Towett, Minister for Education and Chairman of the Kenyan National Commission for UNESCO, is to: create an image of science amongst young people - thus attracting them into scientific and technological careers; make the general public science and technology conscious; and then "enlighten our people on the latest achievements in the field of science and technology".

Among features in the first issue are an explanation, illustrated with diagrams, of how television works; a course that requires acquaintance with the principle of relativity; and a prize essay contest with such topics as "Science in the Service of Man" or "The Type of Science I Would Like to see Taught at School".

This is the third magazine that has been founded in East Africa as a result of UNESCO activities in promotion of public understanding of science and technology. The first has been published since 1969 in Zambia (JETS, Junior Engineers Technicians and Scientists, set up by the Zambia Association for Science Education).

23. LATIN AMERICA

As continuing evidence of the interest of a number of Latin American countries in British science education developments an invitation was extended to the British Council for a visit by Dr R F Kempa of the Chemical Education Sector of the University of East Anglia to visit Argentina, Chile and Peru in March and April 1973. There has been a considerable history of contact between the various Nuffield Foundation Science Teaching Projects and Latin American countries and on this occasion Dr Kempa was invited to Chile to hold a seminar on Nuffield Chemistry teaching at the University of Chile in Temuco. A short visit to Peru was arranged at the end of the assignment which enabled discussions to take place on local needs and conditions in science teaching and ways in which British experience might be utilised by Peruvian science educators. In Argentina the programme consisted of visits to the Institute of Mathematics, Astronomy and Physics (IMAF) at Cordoba and to the Institute for the Improvement of Science Teaching (INEC). In addition to this programme, lectures and seminars were held in each country on British science education in general and on Nuffield Chemistry in particular.

The Nuffield Science Teaching Project seminar at Temuco was planned as a national seminar and a total of 29 participants attended which, although drawn largely from Temuco, included representatives of other regional universities and from high schools in Temuco and Santiago. The seminar extended over two full weeks, and with the assistance of translation facilities from the senior staff members at Temuco, communication and language problems were alleviated easily. A major feature of the seminar included exposure to new experimental methods and to a certain degree to new science teaching equipment appropriate to the Chilean situation. The course was acknowledged as being a most successful one.

24. USA

The National Science Teachers Association of the United States have just appointed Robert L Silber as Executive Director of the Association. Mr Silber who was formerly with the American Chemical Society will join the NSTA Headquarters staff in June 1973 to succeed Robert H Carleton who has been Executive Secretary of the Association since 1948. The National Science Teachers Association address is 1201 16th Street NW, Washington DC 20036.

INTERNATIONAL ACTIVITIES

25. European Science Education Seminar - Science Education in Europe in the 1980s

The Centre for Science Education with assistance from the British Council Science Education Section arranged this Seminar which took place from 24-27 April. Professor K Keohane, Director of the Centre for Science Education, was the host of the Seminar. The Seminar received financial support from the Nuffield Foundation, British Council, ICI Ltd, BP Ltd, Esso Ltd and Shell International Ltd.

Delegates came from Austria, Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and Turkey, as well as the United Kingdom.

The theme of the Seminar was to discuss the future of science education at all levels from school to postgraduate level and to look for ways in which there could be collaboration between European countries. The opening address was given by Professor David Ingram, Professor of Physics, Keele University and Principal-Elect of Chelsea College, London. He spoke on the 'Changing Emphasis in Science' and the need for greater contact between science and the humanities and social studies. He also emphasised the need in his view for integration between the sciences themselves. Other main addresses were given by Dr Eskil Block from Office Belge pour l'accroissement de la productivite, Belgium, on the 'Social Context of Science', Mr Stuart Maclure, Editor, Times Educational Supplement, on the 'Educational Context of the 1980s', Professor Jack Allanson, Professor of Electrical Engineering, University of Birmingham, on 'Science Education for the 1980s' and Professor G Illuminati, Professor of Chemistry, University of Rome on 'European Cooperation in Science Education'.

Apart from the main addresses the members of the Seminar spent time in discussion groups and final reports were presented to the Seminar from each group. It is hoped that these reports together with the main addresses will in due course be made available for members of the Seminar and other interested bodies.

Further information may be obtained from the Centre for Science Education, Bridges Place, London SW6, or Science Education Section, The British Council, Lonsdale Chambers, 27 Chancery Lane, London WC2.

26. Commonwealth Specialist Conference on Teacher Education

This, the sixth in the series of specialist conferences organised by the Commonwealth Secretariat met in Nairobi, Kenya from 26 April - 10 May 1973 and was attended by representatives of nearly all Commonwealth countries.

The Conference took as its main topic the title 'Teacher Education in a Changing Society'. It studied this under six separate themes:

- Education in a Changing Society
- The Role of the Teacher in Educational Development
- The Making of the Teacher
- The Teacher Educator
- The Costs of Education and the Supply of Teachers
- Commonwealth Cooperation in the Field of Teacher Education

The Conference address was given by Dr A Porter, Vice-Chancellor designate of the University of Sierra Leone and the Conference Chairman was Mr Y Komora Director of Education, Kenya. The report of the Conference will be published shortly by the Commonwealth Secretariat, Marlborough House, London W1, England.

Previously Specialist Conferences have been held on:

1961 KAMPALA	Specialist Conference on Teaching of English as a Second Language.
1963 COLOMBO	Specialist Conference on School Science Teaching.
1966 HUDDERSFIELD	Specialist Conference on the Education and Training of Technicians.
1968 TRINIDAD	Specialist Conference on Mathematics in Commonwealth Schools.
1970 ACCRA	Specialist Conference on Education in Rural Areas.
1973 NAIROBI	Specialist Conference on Teacher Education in a Changing Society.

The reports of these are all available from the Commonwealth Secretariat.

27. Guinness Awards Commonwealth Conference on The Social Significance of Science and Mathematics Teaching

This Conference, sponsored jointly by the Guinness Company, the Commonwealth Foundation and the British Overseas Development Administration was held at the University of the West Indies, Kingston, Jamaica from 29 March - 2 April 1973. It was attended by delegates from 17 countries. The keynote address was delivered by Mr Arnold Smith, the Commonwealth Secretary General.

The Conference considered the following broad themes:

- Science, Technology and Society
- Objectives for the Curriculum - Contributions to Society
- Objectives for the Curriculum - Structure, Methods and Content
- Achieving development patterns- Economic aspects
- Achieving development patterns- The Teacher
- Achieving development patterns- The Curriculum

A series of wide ranging discussions highlighted both the major issues and the great diversity of problems within the Commonwealth.

It quickly became clear that detailed research and the collection of relevant data was necessary before major developments in the curriculum could be initiated to take account of the current emphasis on social significance and social relevance in education in general and in science education in particular.

A number of resolutions to this effect were agreed. In particular, to stimulate creative activity in this field, it was agreed that the Guinness Awards Scheme for Science and Mathematics Teachers Overseas, should concentrate in the immediate future on entries concerned with elements of social significance in education.

It is hoped that appropriate organisations, such as the Commonwealth Secretariat, will sponsor major studies in this field to provide the data for development of more relevant science and mathematics curricula.

In order to provide a mechanism for taking further action on the issues raised in the Conference and to look at other aspects of cooperation in science and mathematics education, it was agreed to set up a Commonwealth Association of Science and Mathematics Educators (CASME). This will be composed of individuals throughout the Commonwealth who are recognised as being the leading science and mathematics educators in their countries.

It will provide a powerful source of advice and a medium of consultation at the professional level on all issues affecting science and mathematics education throughout the Commonwealth. It will be organised by Dr C Thomas in the Science Unit of the Commonwealth Secretariat, Marlborough House, London W1, England. Details of the organisation, membership etc will be available later.

A report on the Conference will be published shortly by the Guinness Awards (Overseas) Committee, through the Chairman Mr M Goldsmith, 36 Craven Street, London WC2.

28. International Conference on the Education of Teachers for Integrated Science - ICSU Science Teaching Committee

This Conference was organised by ICSU with the collaboration of UNESCO, the United States International Commission for UNESCO and the University of Maryland. It arose out of the recognition of the international interest in the development of integrated science teaching and in this sense is a follow up of previous ICSU/UNESCO activities in integrated science. The Conference took place at the Adult Education Centre of the University of Maryland from 3 - 13 April 1973 under the Chairmanship of Dr A Baez.

The first Conference on integrated science teaching sponsored by ICSU and UNESCO took place at Varna in Bulgaria in 1968. In view of the presence of the International Clearing House on Science and Mathematics situated in the University of Maryland, the University was chosen as the site for this the second Conference of the series, which concerned itself with the preparation of teachers for the specific requirements of integrated science teaching.

The Conference was attended by over 200 delegates from some 60 countries covering both the developing and developed areas of the world.

The work of the Conference centred around a series of plenary addresses on aspects of this topic, which were thought to be of critical importance and eight working groups which studied in some depth the practical problems facing teachers in this work.

Of particular interest amongst the plenary addresses were those by Professor M Pentz, Dean of Science at the Open University, United Kingdom, speaking on the Open University courses in science and technology and their applicability to the education of teachers for integrated science, Professor K Keohane, Science Education Centre, Chelsea College, University of London, on the preservice education of teachers for integrated science and G Ramsey of the Torrens College of Advanced Education, Keswick, South Australia on the in-service education of teachers of integrated science. Mr J Maddocks the editor of 'Nature' gave a stimulating address on the social responsibility of scientists and the reciprocal responsibility of society. This theme of social responsibility was taken up by Professor J Goodlad of the University of California and by Mr Maurice Goldsmith, Chairman of the Guinness Awards Committee, UK. An address on evaluation was given by Dr M Krasilchik of the University of São Paulo, Brazil.

The eight working groups concentrated on the following topics:

- New approaches to the preparation and in-service training of teachers
- New materials for the education of science teachers
- The role of Science Teachers Associations, Science Inspectors and Advisers
- Contributions of courses other than those in science and science education
- Evaluation of programmes of education and science teachers

Aims and objectives of teacher education for integrated science including the characteristics and competences of the integrated science teacher

The reorientation of specialists for a role in the teaching of integrated science

The role of science teaching improvement projects in centres for the preparation of teachers of integrated science.

A report of the Conference will be available later in 1973. The published proceedings will include the plenary papers and a summary of the discussion arising out of them, a section of some 8-10 pages each summing up the work of the eight working groups together with an annotated bibliography on integrated science teaching. Some of the material of the Conference will be incorporated in a third volume in the New Trends in Integrated Science Teaching series to be published by UNESCO in 1974. The rapporteur of the Conference was Mr P E Richmond of the Department of Education, University of Southampton, SO9 5NH, England.

29. International Confederation of Association for Science Education (ICASE)

For a number of years the International Council of Scientific Unions, Science Teaching Committee has been aware of the widespread need for better communications between National Science Teachers Associations. The presence in Maryland of many representatives of these Associations as participants in a conference on integrated science teaching gave the opportunity to arrange a planning conference to consider the desirability of establishing an International organisation of Science Teachers Associations. Under the sponsorship of UNESCO and ICSU a group of representatives of Science Teachers Associations and interested observers met for two days following the International Conference on the Education of Teachers for Integrated Science to discuss the desirability and feasibility of forming such an International organisation of Science Teachers Associations.

Some preliminary meetings had taken place in Asia and in the United Kingdom and as a result of these a draft constitution was available for consideration as were outline proposals for the activities of such a body.

The meeting agreed that the formation of such an organisation was desirable and it was proposed to attempt to set up an International Confederation of Associations for Science Education (ICASE). Discussions refined some aspects of the proposed constitution and the list of possible activities, included the setting up of a communications system between member associations, the stimulating and catalysis of exchange of personnel, creation of correspondents within each Association concerned with international relationships, possible cooperative research in science education projects and a number of other useful operations. It was agreed to set up an interim committee to pursue the matter in greater detail with a view to organising in due course a formal meeting at which the Confederation could be properly constituted. The interim officers and executive committee of the proposed ICASE are:

President Dr J D Lockard of the International Clearing House,
University of Maryland,

Vice-President Mr B G Pitre of the Doon School, Dehra-Dun, India
Regional Representatives:

Africa Mr J Kusi-Achampong Ghana,

Asia including Australasia Mr J Yip Singapore,

Europe Mr B G Attwood, United Kingdom,

Latin America Miss O Baxter Jamaica,

North America Mrs E Ledbetter USA.

Representing French speaking interests Miss M Souchon France,
Representing UNESCO as an observer Mrs S Haggis Interim Executive
Secretary/Treasurer,
Mr D G Chisman Secretary, Science Teaching Committee, ICSU,
Interim Editor Dr D Cohen, Australia,
Official ICSU observer Professor M Matyas.

The International Confederation will be financed by subscriptions from its member Associations. These subscriptions will be related to the size of the member Association.

30. Guinness Awards for Science and Mathematics Teachers Overseas 1972/73

The awards under this scheme for 1972/73 were announced at the annual presentation ceremony held at the Royal Society on Tuesday 19 June. In the overseas section there were three awards:

First Prize 'Project on Protein Malnutrition' from Mrs S J Dabek, The Queens School, Central Avenue, Constance Spring, Kingston, Jamaica. The entry was essentially prepared for a science exhibition organised by the Association of Science Teachers of Jamaica in 1972. The judges awarded a prize of £100 with the recommendation that £50 should be given to the school and £50 to Mrs Dabek.

Joint Second Prize 'Ecology of the Johore Straits - and a preliminary study of a species of water snail the Pila' by Mr Charles Singaram of West Malaysia. This was essentially a double entry of two ecological studies one outdoors and one indoors. It was well presented and carefully documented with ample photographs and detailed proof of practical activity by the class. It was a teacher directed class activity or project. The entry was prepared originally as a contribution to a local science fair in Malaysia. A prize of £50 was awarded.

Joint Second Prize 'The use of structures in teaching physics - school Science Project - East Africa' from Mr A C E Jarvis, Uganda. This entry contained highly original material. It was well presented with many detailed activities written in. There was ample evidence of considerable experimentation and development work in actual class situations and improvisation of equipment had been a major feature of the project. A prize of £50 was awarded.

GUINNESS AWARDS FOR SCIENCE AND MATHEMATICS TEACHERS

1973/74

1. Aims of the Scheme

The purpose of these awards is to encourage teachers in schools and colleges overseas in the development of their teaching of science and mathematics.

The recent Guinness Conference on the Social Significance of Science and Mathematics Teaching, held in Jamaica in March/April 1973 recommended that in the immediate future these awards should concentrate on encouraging teachers to be more active in creating and developing new teaching materials with particular reference to the education of their students in social aspects of science and mathematics.

The awards emphasise the necessity to have regard for local needs and conditions in developing new science and mathematics curricula. Social significance as used above is intended to include this, but also to cover the much wider field of the impact of science and mathematics through technology on the community.

2. Countries Involved

The following countries overseas have been involved in the scheme in recent years:

Associated States of the Eastern Caribbean, Barbados
Belize, Botswana, Cyprus, Ethiopia, Ghana, Guyana,
Hong Kong, Jamaica, Kenya, Lesotho, Malawi, Malaysia,
Malta, Nigeria, Sierra Leone, Singapore, Sudan,
Swaziland, Tanzania, Trinidad and Tobago, Uganda.

The organisers would be happy to receive entries from other countries as well.

Full details are given below of the arrangements for the 1973/74 competition.

3. Topics for the Competition

Awards will be made on the basis of reports submitted to the Judges relating to the following aspects of science and mathematics education:

- the development of teaching materials aimed at introducing pupils to the broad field of social impact of science and mathematics

Aspects of science and mathematics education suggested as suitable for consideration are:

- the development of curricula and syllabuses
- the design and production of teaching materials to meet special needs
- investigation of the learning process in relation to study and teaching
- the planning, equipment, provision and use of laboratory facilities, including resourceful solutions to meeting needs in circumstances of limited facilities
- a science exhibition contribution.

These subject areas will remain as broad areas within which new materials may be developed and under which entries may be submitted, but in each entry the relationship of the work carried to its social context and its impact on the nation, community or individual must be made clear. (See para 9 below for suggested topics for consideration).

4. Awards

Awards will be to the value of £100, £50, £25 or £10 according to the decision of the Judges. For this purpose, a sum of £350 will be available annually, provided by the kind generosity of Guinness Limited. The right is reserved to refrain from awarding prizes of the maximum value if the Judges advise that no candidate has submitted an entry worthy of the award. In the event of no prize of £100 being awarded the prize money may be divided in whatever manner appears equitable in the light of the Judges' recommendations. The decisions of the Judges will be final, and no correspondence will be entered into concerning their decision.

These awards are being made in collaboration with THE SCIENCE TEACHER magazine, London, as administrator of the Guinness Awards.

5. Judges

The Judges for the year 1973-74 will be:

Mr D G Chisman Deputy Director of the Curriculum Division,
Centre for Educational Development Overseas,
and Secretary of the Committee on Science
Teaching of the International Council of
Scientific Unions.

Dr G Howell Head of the Science Education Section,
The British Council.

Dr J Maraj Assistant Commonwealth Secretary General.

6. Categories of Entrants

Entries are invited from teachers in primary, secondary or tertiary education institutions.

Entries may be submitted by either individuals or syndicates (eg the science staff of a school or college, or a partnership of teachers from more than one institution).

7. Presentation of Entry

Only one entry can be accepted from any one entrant or syndicate.

The entry must be written or typed on one side of quarto sheets of paper. Reports should not exceed 10,000 words in length and normally might be expected to be of the order of 2,000 - 5,000 words.

Photographs and other illustrative material should be included wherever relevant, together with any other evidence that shows the ideas have been effective in practice. Such evidence should include the work of pupils whenever possible.

Reference should be made to the source of information or of original experiments wherever this is necessary to a proper assessment of the proposed modifications. If any substantial part of an entry is being published or submitted as a thesis, this should be mentioned on the top sheet of the entry.

The Judges will pay more attention to evidence of original thought and ingenious application than to mere bulk. Moreover, as stated in paragraph 10 the report should be based on personal experience and work which has been actually tried out long enough to provide some evidence of its value.

8. Dates

Registration must be made before 1 December 1973.

Entries from officially registered candidates must arrive in Science Education Section of the British Council before 10 February 1974.

The awards will be announced by 31 May 1974.

9. Topics suggestions

The Topics - an entry may be on any topic which falls within the general field of reference given in the preceding description of the scheme.

Previous entries have included the following topics:

Report of a prizewinning contribution to a science exhibition. (The material submitted must show some originality and/or ingenuity in presentation and its authenticity be certified by the organisers of the exhibition). The report, which may be supported by photographs or drawings, must provide sufficient information for a person reading the report to be able to replicate the contribution. (Actual equipment or materials used should not be submitted).

The organisation of individual and group practical work in a selected area of the science course.

Schemes to develop pupils' mathematical concepts of problem solving.

An example of children's activity at primary or secondary level showing the integration of mathematics and other curricular subjects.

Concept difficulties of children in the area of learning science.

How to teach science with a limited amount of laboratory equipment and space.

Laying the foundations of science education in a primary school.

A teaching programme in science or mathematics for the whole or part of a school course.

Development of courses in Integrated Science

Field studies in chemistry, or physics, or biology or elementary science

A detailed ecological study of a given area.

The place of science in the local home today.

Activities of school science clubs.

A teaching/learning programme integrating science with other curricular studies.

It is intended that, whichever the topic of the entry, it should be based on personal experience and should include a substantial account of teaching and/or other education work actually carried out on the suggested lines, with relevance to the social significance of the activities described.

10. Treatment of the selected topics:

The Judges will be glad to consider any reasonable treatment of the selected topic provided it is based on personal, or team, experience and it includes a substantial account of teaching and/or education work actually carried out relevant to the topic. The Guinness Awards scheme is intended to reward original teaching carried out for long enough to enable a reasonable assessment of it to be made. Entries which are only suggested schemes, new programmes, or revised syllabuses which have not been tried out will not be considered. Judges may return an entry for submission at a later date if it shows promise but has been submitted prematurely.

The following may be of help to intending entrants. While these may provide guidelines for the construction of an entry, it is not suggested that this is the only form of submission:

An account should be given of:

- the background to the work;
- the particular difficulties or problems which were to be solved, or other reasons for the work;
- the thinking (principle) on which action was based;
- what action was taken and how it was carried out;
- reactions and results;
- further action to be taken or rethinking.

Application for Registration must be made before the date given in paragraph 8 above.

Intending applicants should therefore apply early for registration forms to:

1. Your local British Council Office or
2. Science Education Section, The British Council, Lonsdale Chambers, 27 Chancery Lane, London WC2A 1PJ, England.

REGISTRATION FORM

THE GUINNESS AWARDS FOR SCIENCE AND MATHEMATICS TEACHERS

Administered

- a. locally by: Your local British Council office.
- b. in London by: Science Education Section
The British Council
Lonsdale Chambers
27 Chancery Lane
London WC2A 1PJ

in association with THE SCIENCE TEACHER, London, which is General Administrator, The Guinness Awards.

PLEASE READ THIS CAREFULLY BEFORE COMPLETING THE FORM

Entries cannot be considered unless a Registration Application duly completed has been received by the Administrator named above, by 1 December 1973. As acknowledgement of receipt of the Registration Form, a Top Sheet will be sent to you giving your Registration number. This number will be the only means of identification of your entry; therefore, the Top Sheet must be submitted with your entry. (Note: where the registration is being sent to London, the information requested in the following paragraphs may be sent out on a postal air-letter form.)

Name of entrant or person nominated to act for a syndicate (block letters, surname underlined please):

..... Mr/Mrs/Miss 1.

Private address:

.....

School or College address: 2.

.....

Qualifications, with dates (eg degree, teacher's certificate or diploma)

.....

.....

Brief record of teaching service and present position

.....

I have/have not previously submitted an entry for the Guinness Awards Scheme

If so, please give details:

~~This entry has/has not been submitted for consideration in other competitions~~

~~If so, please give details:~~

IMPORTANT

1. If your address changes between completing this form and notification of the Awards, please advise Guinness Awards, c/o Science Education Section, The British Council, Lonsdale Chambers, 27 Chancery Lane, London WC2 1PJ.

2. In the case of a syndicate entry please list, on a separate paper, names, qualifications, teacher experience and present position of all members.

PART A - TOPIC *

Either: I/We have chosen to deal with the following topic taken from your suggestions (give title)

.....

OR: I/We prefer to deal with the following topic of my/our own choice. A synopsis of the proposed line of approach is set out on the accompanying sheet of paper:

.....

.....

Signed Date

PART B - DISPOSAL OF ENTRY *

Either: If my/our entry receives an award, first publication rights are thereby assigned to THE SCIENCE TEACHER.

Signed (for syndicate)*

Date

OR: If entry does not receive an award:

Return entry to me/us * or THE SCIENCE TEACHER * may retain my/our entry with first publication rights.

Signed (for syndicate) *

Date

* Delete parts which are not applicable